CMP 160:Spring 2007

Homework Assignment # 2

Due date: May 31 at the beginning of the class

Parametric Curves.
The matrix for drawing Bézier curves is

$$\begin{bmatrix} -1 & 3 & -3 & 1 \\ 3 & -6 & 3 & 0 \\ -3 & 3 & 0 & 0 \\ 1 & 0 & 0 & 0 \end{bmatrix}$$

In other words, the blending functions are $(1-t)^3$, $3(1-t)^2t$, $3(1-t)t^2$ and t^3. Assume you want to draw a curve segment using the control points (0,0) (1,1) (2,1) (3,0).

1. What is the first point (x,y) on the curve (where the parameter t = 0)?
2. What is the point (x,y) on the curve where the parameter t = .5?
3. Use de Casteljau Algorithm to compute the point (x,y) on the curve when the parameter t = .5?
4. What are the relative contributions of the four control points when t = 1?
5. What is the tangent to the curve at t = 0?

Hierarchical Modeling:

1. A cubical table is defined in its local coordinate frame centered around the origin and with sides of length 4. It is to be placed in the world so that it is resting on the xz-plane and centered at $(1, 1, 2)$. What is the matrix that transforms the table points from local to world coordinates? Call it $M1$.
2. A cylindrical vase of radius 3.0 is defined in its local coordinate system centered around the y-axis and extends from 0 to 2 in y. If it is placed on the table at the table's center top surface, what is the matrix that describes points in the vase frame as seen from the table frame? Call it $M2$.
3. The vase is knocked over by a z-rotation of 90 degrees. (Do not worry if it sinks into the table.) What is the matrix that describes this rotation? Call this matrix $M3$. What are the matrices (list them in their proper order) that describe the vase points in terms of the world frame?
4. What is the location of the center top of the vase seen from the world space origin?